REMARKS

Claims 1 and 8 have been amended. Claims 1-26 remain in this application. In view of the above amendments and the following remarks, reconsideration of the office action is respectfully requested.

Claims 1-7 and 16-21 have been rejected under 35 U.S.C. §103 as being unpatentable over Misewich et al. (US 6,365,913) in combination with Chu et al (U.S. Publication 2004/0227154). The Office Action states that it would have been obvious to one of ordinary skill in the art of making semiconductor devices to use the range for the thickness of channel of Chu in the device of Misewich to achieve enhanced hole mobilities. The Office Action further states that the channel would inherently have carriers, which are inherently controlled by the gate.

The characteristics Misewich et al. used to distinguish their device from a MOSFET also distinguish their device from the present device. Misewich et al. described a MOSFET (column 1, line 22) as controlled by the potential on "the gate electrode, which affects the width of the conducting channel and/or the number of mobile carriers in the channel."

In contrast, Misewich et al. described their device (column 7, line 21) as "... a novel device similar in architecture to a conventional silicon FET, but with a channel consisting of a material capable of undergoing a Mott metal-insulator transition."

The present device uses a metal instead of a semiconductor channel in which the width of the conducting channel and/or the number of mobile carriers is affected by the potential on the

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gate. In the present device, the channel is not a metal oxide (as stated by Misewich at Col. 6, line 12) and does not undergo a Mott metal-insulator transition as described by Misewich et al.

In the present work, "metal" is used in the common sense of the word and includes naturally occurring metals. It also includes natural or man-made combinations of those naturally occurring metals including metal alloys. It also includes metal silicides, metal salicides, metal nitrides, layered metals, and doped versions of the preceding materials, but does not include insulators such as oxides. Further, the high off-state resistance of Applicant's invention is accomplished by removal of the carriers from the channel or by the introduction of a p-n junction to block the flow of carriers.

In contrast, Misewich et al. disclose a device with a channel consisting of a metal oxide material layer (see col. 2, lines 52-54) which forms a channel of "Mott Hubbard insulator materials", capable of undergoing a Mott-metal insulator transition. All of the teachings of Misewich et al. are of devices made entirely of such oxide materials. Misewich et al. utilize an oxide channel, and in fact, teach away from the use of a metal channel as in Applicant's invention. The Misewich et al. device (see column 4, line 5) utilizes a conventional silicon FET with a channel consisting of an oxide material capable of undergoing a Mott-metal-insulator transition. The preferred embodiment of Misewich utilizes channel layers of La_2CuO_4, (LCO) or $YBa_2Cu_3O_{7-8}$ (YBCO) or $Y_{1-2}Pr_xBa_2Cu_3O_{7-8}$ (YBPCO) for p-type channels and Nd_2CuO for n-type channels (see col. 6, lines 44-48).

The use of Misewich et al. in view of Chu et al., neither teaches nor suggests adaptation of a FET to metal channels to which the present invention is directed. While Chu et al. does

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teach the use of a Ge channel of 1.5 to 2.0 nm, Chu et al. (see paragraph [0006]) teaches that the active channel must have both the Ge layer and a conductive SiGe layer and, in fact, Chu et al. (see paragraph [0050]) states "...channel composite structure... is a $Si_{0.2}Ge_{0.8}$ channel with a thickness in the range from 7 to 8 nm and layer 16 is a Ge channel with a thickness in the range from 1.5 to 2.0 nm." Since the present device has neither a Ge nor a SiGe channel, it is not obvious why these thicknesses apply to a metal channel. Further, the channel of Chu et al. has a first layer that is 7 to 8-nm thick and a second layer that is 1.5 to 2.0 nm thick which has no resemblance to the channel of Applicant's invention.

The Applicant's claims reflect Applicant's discovery that thin (less than 5 nm) highly conductive metals, metal alloys, doped metals, layered metals, highly conductive silicides, highly conductive salicides and highly conductive nitrides, for example, can be used as channels in transistor devices to provide increased speed and transconductance over other well-known FET and MOSFET devices in the prior art. The metal channel of materials claimed by Applicant at a thickness less than 5 nm is not taught or even suggested by the Misewich et al. reference relied upon by the Examiner. It is not possible for Misewich et al. to suggest such materials when Misewich et al. do not even acknowledge that such components exist. Moreover, because Misewich et al. fails to teach or suggest the channel materials as claimed by Applicant, then Misewich et al. certainly also fails to teach or suggest devices, modes (such as enhancement mode or depletion mode devices) or combinations of such as required by dependent claims 2-7 and 9-26. For these reasons alone, the rejection of the claims should be withdrawn.

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Further, the Examiner's arguments based on inherent properties cannot stand when there is no supporting teaching in the prior art. In re Spormann, 363 F.2d 444, 150 USPQ 449 (CCPA 1986). Accordingly, there is an insufficient basis for a finding of *prima facie* obviousness.

Claims 8, 9, 10, 11, 12,13,14, and 15 and 22-26 were rejected under 35 U.S.C. 103(a) as being unpatentable over Wei et al. (US publication 2004/0169227) in combination with Misewich et al. (US patent 6,365913), Chu et al. (US publication 2004/0227154), Song et al. (US patent 2004/0149579) and Ogura et al (US publication 2002/0045319).

Wei et al. teach doping the bulk silicon substrate underneath silicon-on-insulator devices to reduce off-state leakage currents. Wei teaches the use of a silicon channel with a thickness of 5-30 nm (Wei at paragraph [0022]). Misewich et al. teaches the use of a Mott oxide material, such as YBCO, in the channel. Furthermore, at col. 3 line 39-46, suggests that the thickness of the Mott material be 200 Angstroms (20 nm) because that thickness "enables control of the stoichiometry of the Mott transition layer, yielding desirable qualities, including sheet resistance."

Mott material does not have the properties necessary to make the present device. For example, the conductivity is poor compared to the metal materials taught for the present device and the mobility is especially poor as the transistor approaches the off state.

In the present case, none of the prior art cited in the Office Action suggests the selection and use of metals, metal alloys, doped metals, layered metals, highly conductive silicides, highly conductive salicides and highly conductive nitrides for metal channel layers in transistor devices, as required by all the

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claims. Further, there is no teaching or suggestion in Misewich et al. of the device of claims 1-26. It is equally well established that the prior art must provide a motivation or reason for one skilled in the art, without the benefit of applicant's specification, to make the necessary changes in the reference device. In the present case, the Office Action has not presented any evidence to support the conclusion that one skilled in the art would have had any motivation to make the presently claimed structure.

The rejection of present claims 1-26 over Misewich is also improper because the Office Action has failed to consider the teachings of the prior art, which lead away from the claimed invention. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1595 (Fed. Cir. 1988). Claims 1-26 all require that the device have a metal channel of a thin film metal, metal alloy, doped metals, layered metals, highly conductive silicides, highly conductive salicides and highly conductive nitrides. In contrast to the invention covered by claims 1 - 26, Misewich teaches only the use of metal oxides that undergo an insulator-metal transition. The Mott transition is critical to Misewich's invention, and does not relate to the Applicant's claimed invention. Misewich et al., when considered as a whole, thus teaches away from the requirements of claims 1-26. A skilled artisan would therefore tend to ignore the devices of Misewich in practicing the claimed invention.

The Song and Ogura references also fail to teach or suggest the claimed invention alone, or in combination with the other cited references. Applicant submits that any motivation to combine the teachings of the cited references comes solely from the present application and not from the references themselves.

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As such the rejection is improper. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

The combination of Misewich with the other cited references does not cure Misewich's failure to provide a motivation to use a thin film metal, or the combination of metal materials set forth in the independent claim 8, i.e., a metal alloy, doped metals, layered metals, conductive silicides, conductive salicides and conductive nitrides as metal channels in transistor devices, as in Applicants' invention. The particular features of Applicants' invention are not taught or in any way suggested by the cited references, taken individually or in combination. Conversely, the Applicant's teachings do not include the use of oxides in the channel.

Applicants note the Kreupl reference, which fails to disclose or suggest the use of a "p-type hole metal" as recited in claim 1, or the use of an n-type metal channel with a p-type source and drain as recited in claim 8.

Accordingly, reconsideration and withdrawal of the rejection under 35 U.S.C. §103 is respectfully requested. If an independent claim is nonobvious under 35 U.S.C. 103, then any claim depending from the independent claim is nonobvious. Therefore, claims 2-7 and 9-26 should also be allowable.

Claims 1 and 8 have been amended. Claims 1-26 remain in this application. Applicants respectfully request the Examiner to consider the above remarks and for the reasons stated above, allow the remaining claims in this application.

In light of the foregoing, it is respectfully submitted that the present application is in a condition for allowance and notice to that effect is hereby requested.

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The Examiner is encouraged to telephone the undersigned attorney to discuss any matter that would expedite allowance of the present application.

Respectfully submitted,

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